

Aesthetic Alteration of the Chin

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Abstract

Keywords

- genioplasty
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- alloplastic chin augmentation

Genioplasty, the alteration of the chin through either osseous manipulation or implant augmentation, is an integral component of aesthetic surgery of the face. When performed with proper preoperative assessment and technical execution, the results can harmonize and restore balance between skeletal, soft tissue, and dental components of the lower face. To this end, proper understanding of the underlying anatomy and the changes associated with movement of the chin, alone or in conjunction with formal orthognathic surgery, is paramount. The author presents pertinent points on proper assessment, treatment planning, and a description of the surgical technique, and discusses complications and outcomes to optimize outcome.

Background

The chin, which is an area defined by the labiomental crease superiorly, the oral commissures laterally and the submental-cervical crease inferiorly, is often overlooked when it comes to the aesthetic alteration of the face. However, a chin that is of right size, shape, and contour is important for a well-balanced and harmonious face. We often hear the terms “weak” or “strong” chin to describe chins of a certain morphology that have both emotional and psychosocial consequences. Therefore, the art and science behind the surgical alteration of the chin, both in isolation or as part of an integrated alteration of the facial osseocutaneous morphology, is an important component of orthognathic surgery.

Genioplasty, the alteration of the chin through either osseous manipulation or implant augmentation, is one of the more commonly performed cosmetic procedures today.¹ However, alteration of the chin will cause both predictable and unpredictable changes to the balance between maxillomandibular morphology, dental relationship, and the soft tissue envelope that need to be factored in prior to making the decision to proceed with the proposed procedure. Pertinent anatomy and historical background have been described elsewhere in the literature.^{2–6} Here, I will present pertinent points on proper assessment and treatment planning, describe different surgical techniques, and discuss complications and outcomes to optimize outcome.

Preoperative Assessment

Gender, ethnicity, age, and medical comorbidities are important factors to consider in overall treatment planning for genioplasty. From a morphologic standpoint, men tend to have wider, square faces often with more projected chins that may have two-point light reflection.³ Women, on the other hand, tend to have narrower faces with single-point light reflection on the chin. Age can be a factor in the young and elderly population. In younger patients, one must avoid performing mandible surgery too early because the lower facial skeleton will continue to grow.⁷ The dentition is not fully erupted until 15 years of age, putting it at greater risk of injury during osteotomies. Moreover, in elderly or edentulous patients, one must evaluate whether alloplastic augmentation might be more suitable due to the possibility of poor bone stock. Most importantly, genioplasty is an elective procedure and should only be performed in patients who are medically fit. Smoking, though not a contraindication, increases the risk of complications, including delayed wound healing and graft failure if genioplasty requires a bone graft.⁷

Next, a complete analysis of the lower face and its relationship to the rest of the face should be undertaken, taking into consideration the dental relationship, maxillomandibular skeletal morphology, and the soft tissue envelope. The purpose is to determine whether genioplasty alone or formal orthognathic surgery addressing maxillary and/or mandibular dysmorphology would best fit the patient's aesthetic goals.

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Dental Morphology

Evaluation of occlusion and dental relationship is crucial in determining if a procedure is necessary, and if so, which procedure would best address the patient's dysmorphology. Angle classification is used to establish the relationship between maxillary and mandibular dentition.⁸ In patients with normal class I occlusion, any chin deformities can be managed with isolated manipulation of the chin.³ However, patients with class II or III occlusion require further evaluation to decide whether they will be better served with a combination of mandibular and maxillary osteotomies with or without genioplasty. The presence of any dental compensation and history of previous orthodontic treatment, if any, are an important part of the patient's dental history because underlying skeletal dysmorphology could be revealed upon evaluation. Lastly, poor or infected dentition should be treated prior to any discussion about genioplasty.

Skeletal Evaluation

Cephalometric analysis remains the guiding principle behind any manipulation of the facial skeleton. However, a formal lateral cephalogram is unnecessary in most cases. Most patients can be adequately examined with a combination of proper soft tissue and dental evaluation.³ Notwithstanding, cephalometric principles remain central to guide treatment planning as they form the basis for many of the soft tissue relationships. In complex cases, formal osseous cephalometric examination, such as the Steiner analysis, is helpful in grasping the relationship between the skull base, maxilla, and the mandible.⁹ The relationship between sella-nasion-subspinale (SNA) and sella-nasion-supramentale (SNB), as well as the relationship between the maxilla and mandible (ANB) can help to ascertain whether formal orthognathic surgery is necessary (► Fig. 1). Furthermore, adding chin points pogonion (Pg) and menton (Me) to the analysis can help determine whether concomitant genioplasty is recommended.

Soft Tissue Analysis

Several tools exist to help with soft tissue analysis and every surgeon has a preferred set of analyses that he or she uses in determining whether genioplasty is needed and the type of movement required. Some of the more commonly used analytic tools will be discussed here, but this discussion is not meant to be a comprehensive review of all that is available.

Every patient should be viewed from both frontal and sagittal views. A life-size photograph to include bilateral sagittal, frontal, and bilateral oblique views can be helpful.¹⁰

From the front, lip competence and facial height and symmetry can be analyzed. In addition, the face should be analyzed with lips in repose as well as while smiling to see the dynamic soft tissue changes with animation.

1. Lip competence—Patients with lip incompetence may prefer the aesthetic outcomes of osseous genioplasty over implant augmentation to correct this deformity.⁷
2. Facial height—Facial proportion, the height of lower third of the face in relation to middle third of the face, should be



Fig. 1 Significant cephalometric points. S, sella – point at center of sella turcica; N, nasion – point formed at the frontonasal suture; A point, subspinale – point of deepest concavity at anterior maxilla; B point, supramentale – point of deepest concavity of anterior mandible; Pg, pogonion – most projected part of the mandibular symphysis; Me, menton – lower point of the symphysis of mandible.

measured to decide whether augmentation or reduction is recommended. Incisor show is a physical evaluation tool used as a reasonable indicator of facial height dysmorphology. Increased incisor show and/or mentalis strain can point to a long-face growth pattern whereas decreased incisor show can signal a short-face growth pattern, both of which may be better corrected by addressing the underlying maxillomandibular skeletal dysmorphology with orthognathic surgery.

3. Facial symmetry—Asymmetries of the mandible and chin may require asymmetric movements and/or multiple osteotomies.

Next, the profile view of the face is analyzed and the following points should be addressed:

1. Labiomental fold—The indentation between the lower lip and lower portion of the mandible is an important characteristic to recognize in chin aesthetics. In doing so, the vertical proportion of mandible and the facial length need to be assessed and both the height and depth of the fold should be studied.¹¹ Ideally, the fold should fall at the junction of upper and middle third when the distance between stomion and menton is divided into thirds. The fold should be ~4 mm in men and 6 mm in women.¹² A deep fold may be exaggerated in horizontal augmentation, whereas a shallow fold may be effaced further by vertical augmentation. A patient who has combination of long lower face and a deep labiomental fold should not be offered genioplasty as these patients require formal orthognathic correction.¹³

2. Lip–chin relationship—A simple line connecting the most prominent portion of the upper and lower lip that on a balanced face should touch the pogonion (Riedel line) (►Fig. 2).³ Generally speaking, the lower lip should be 2 to 3 mm posterior to the upper lip and the pogonion should never project beyond this line.
3. Cervicomenal angle—The angle between the chin and the neck should be 105 to 120 degrees. Adjunctive treatments to enhance soft tissue contour of the neck, such as submental lipectomy, can enhance chin aesthetics, and should be considered for every patient.
4. Nose–chin evaluation—The aesthetics of the nose and the chin should harmonize. Ideally, chin projection should lie ~3 mm posterior to a line drawn in the nose–lip–chin plane (►Fig. 3).¹⁴

Lastly, the skin of the lower face should be examined in both frontal and profile views, noting the quality, thickness, and laxity as well as any irregularities. Because these factors can impact outcome, a patient's expectations should be managed by discussing these factors in the preoperative setting. Presence of ptosis of soft tissue caudal to menton and an exaggerated submental crease (witch's chin) may require soft tissue/muscle resection and/or repositioning. With this presentation, implant augmentation may exaggerate the deformity. On the other hand, existence of excess submental skin can be addressed with a submental incision to remove an elliptical segment around the incision to avoid skin ptosis.³ Dynamic



Fig. 2 Riedel line: A line drawn vertically down the facial plane connecting the most prominent portion of the upper and lower lip. This line should touch the most prominent anterior portion of the chin in a balanced face.



Fig. 3 Nose–lip–chin line: A line drawn vertically down the facial plane connecting most projecting point of the nose and most prominent portion of the upper lip. Most prominent anterior portion of the chin should be ~3 mm posterior to this line.

and static chin pad analysis is useful to assess changes with proposed movements or augmentation.¹⁵

Treatment Approach

Once preoperative assessment is complete, it is important to organize the information gathered to formulate an optimal treatment plan. As expected, some of the decision hinges on each surgeon's subjective opinion and previous experience. Further, because this is usually an elective procedure, each patient's desires and goals should be considered. For example, a formal orthognathic surgery is a time-consuming and costly endeavor that not all patients will be willing to undertake. It is important in these situations to discuss with the patient whether genioplasty alone or in conjunction with treatments other than orthognathic surgery can achieve some of the desired goals of the patient, and if so, whether to proceed with surgical intervention. For example, genioplasty combined with rhinoplasty and/or submental lipectomy can make a significant difference with very high patient satisfaction.³

Surgical technique for genioplasty falls into two broad categories: osseous genioplasty and alloplastic augmentation. Generally, most surgeons are more comfortable inserting an implant rather than performing osteotomies. With proper patient and implant selection, implant augmentation achieves desirable results and is easy to execute.¹⁶ However, osseous genioplasty, contrary to some surgeons' beliefs, is not a difficult procedure to perform; moreover, it is a highly

versatile procedure that can allow movement in all dimensions. It can ameliorate conditions that an implant cannot, such as a chin that is too long, too short, or asymmetric.¹⁷ In addition, patients who have had one or more failures of an alloplastic chin implant are perhaps best treated by an osseous genioplasty.¹⁸

Osseous genioplasty and alloplastic augmentation entail the usage of different types of anesthesia; therefore, each patient's overall health, tolerance of anesthesia, and anesthesia preference should be acknowledged because that analysis may dictate the patient's personal preference in selecting between osseous genioplasty and alloplastic augmentation. The majority of implant augmentation can be performed under local anesthesia, with or without sedation. Osseous genioplasty, however, should be performed with at least intravenous sedation in a controlled setting by a certified registered nurse anesthetist or anesthesiologist for both optimal pain and airway control. Most patients undergoing osseous genioplasty, in fact, elect to have general anesthesia, which in many ways makes it easier for the surgeon and can shorten the operating time.¹⁹

There are countless variations to surgical techniques for both osseous genioplasty and alloplastic augmentation. In general, the surgical principles and key steps are substantially similar. The minor nuances and differences are attributed to surgeon preference stemming from individual experience. Thus, my preferred technique for both isolated osseous genioplasty and alloplastic augmentation is provided below.

Surgical Technique: Osseous Genioplasty

1. Incision—An intraoral incision is used and preferred for osseous genioplasty. After providing appropriate sedation or anesthesia, the chin is injected with lidocaine contain-

ing 1:100,000 epinephrine in and around the proposed incision as well as areas of dissection and osteotomy. Next, the lower lip is stretched outward to allow visualization of the mental nerve through the mucosa.⁶ The incision should remain between the visible nerve. An incision is made leaving a generous cuff of mucosa and muscle that will allow for a watertight closure. An incision is carried down through the mucosa and muscle with electrocautery.

2. Dissection—Dissection is then performed in the subperiosteal plane with a periosteal elevator to expose the anterior surface of the chin while visualizing and protecting the mental nerve coming out of the foramen. It is important to avoid extensive dissection as the soft tissue attachments help to stabilize the skeletal alteration, minimize unpredictable soft tissue changes, and lessen postoperative osseous resorption.²⁰ As much tissue as possible should be left on the anterior surface of the symphysis to prevent ptosis of the chin pad.¹⁹ There is also no need to dissect above the mental nerve on either side as that can increase the chances that the nerve will be excessively stretched or avulsed.⁶
3. Osteotomy—After proper retraction, a sterile pencil is used to mark the location of osteotomy, which should lie at least 5 mm below apices of canine teeth and 6 mm below the mental foramen to reduce the chance of injuring either the tooth root or the nerve.²¹ The exact location and angle of the osteotomy will depend on planned movement (→Fig. 4).²² First, an oscillating saw is used to make a vertical groove in midline perpendicular to planned osteotomy that will be used as a midline reference point. A drill hole can be placed at this point in the midline within the distal chin where a screw can be partially inserted later to be used as a convenient retractor for the osteotomized

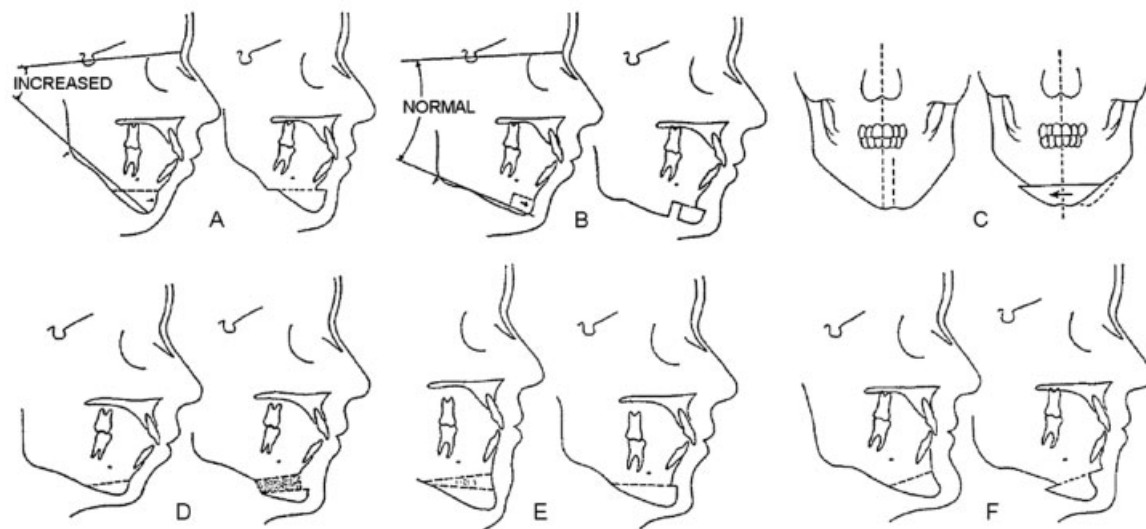


Fig. 4 Horizontal osteotomy techniques. (A) sliding oblique horizontal osteotomy; (B) step horizontal osteotomy; (C) horizontal osteotomy for asymmetry; (D) sandwich horizontal osteotomy with osteotomy; (E) horizontal osteotomy with osteotomy; (F) correction of macrogenia by horizontal osteotomy. (Reprinted with permission from Hinds E, Kent JN. Genioplasty: the versatility of horizontal osteotomy. *J Oral Surg* 1969;27:690–700).

chin segment. A wide saw, which tends to maintain orientation and limit canting, is used next to perform an osteotomy of the central portion. An osteotomy of the lateral segments is then performed with a narrow saw. It is important to make complete cuts, and particular attention should be paid along the posterior lingual cortex to prevent an incomplete osteotomy. If a wedge resection is planned, the caudal cut should be made first so that the second, cephalad cut, can be made on stable bone that remains attached to the mandibular symphysis. An ample amount of contact irrigation is recommended throughout the osteotomy to prevent burning the bone and creating focal osteomyelitis.

4. **Planned movement and fixation**—The distal chin is then moved into the desired position, with the direction and amount of movement dependent on preoperative planning (► **Fig. 4**). For positioning of the distal segment, a screw can be partially inserted into a predrilled hole (as described above) and a wire twister can be used to hold this screw to use as a retractor. A three- or four-hole straight titanium plate can be contoured and secured to both proximal and distal segments on either side of the osteotomy (usually inferior and in between lateral incisor and canine on each side). Prebent genioplasty plates can also be used with size dependent on degree of advancement. At this point, the positioning screw can be removed.
5. **Refinements**—If significant vertical or horizontal lengthening is planned (> 5 mm), then an interpositional graft (autograft, allograft, off-the-shelf material such as hydroxyapatite) is shaped and placed in the defect.⁶ The greater the angle of osteotomy from the occlusal plane, the shorter the chin will be.¹⁹ Moreover, a greater angle also leads to a larger step off along the inferior border of the mandible as the osteotomized segment is advanced, which may be visible and palpable in some patients. A rasp can be used to soften the contour if there is any doubt. Lastly, an attempt can be made to improve on contour irregularities and pre-existing asymmetry with a bur. However, multiple osteotomies or asymmetric osteotomies may be better in providing more predictable and symmetric results.
6. **Closure**—The wound is copiously irrigated to remove any debris. The muscle is then reapproximated with resorbable suture and the incision is closed using 4–0 chromic mattress sutures.

Surgical Technique: Alloplastic Chin Augmentation

1. **Implant selection**—Silastic and porous polyethylene are the most commonly used implants for genioplasty today. The type of implant, for the most part, is dependent on each surgeon's preference and experience. I prefer to use a two-piece porous polyethylene implant because it supports soft tissue ingrowth, curtails fibrous encapsulation, and lessens shifting as compared with a silastic implant.²³ Porous polyethylene implants, however, may be more

difficult to place and to remove due to soft tissue adherence and soft tissue ingrowth, respectively. A myriad of implant shapes and sizes are available depending on the magnitude of deficiency. Some chin implants extend beyond the chin territory to contour the mandibular body.

2. **Incision**—Although both intraoral and submental incisions can be used, I prefer to use the submental incision because it allows for better visualization and more accurate contouring and placement of the implant.
3. **Dissection**—Dissection is performed in the subperiosteal plane. Wide dissection is performed to improve visualization and allow more accurate implant placement. Silastic implants have higher propensity to erode the underlying bone so consideration should be given to placing it in the supraperiosteal plane.³ However, the chance of soft tissue injury and skin irregularities are increased in the supraperiosteal plane so this approach should be performed with caution.
4. **Implant placement and fixation / closure**—A two-piece porous polyethylene implant is shaped and contoured to fit as closely as possible to the native contour of the symphysis, and if desired, the body of the mandible. Decreasing the dead space between the implant and the underlying bone is important to prevent complications. The implant is fixed to the mandible with titanium screws. The wound is irrigated and closed in layers.

Complications and Outcomes

Both early and late complications can occur after genioplasty, including poor aesthetic results, hematoma, infection, malposition, and nerve injury.^{9,24} However, a full discussion of all complications are beyond the scope of this article. Discussion about management and avoidance of complications in chin augmentation can be found elsewhere in the literature.²⁵ The incidence of reoperation after genioplasty is extremely low and usually involves replacement of implant or removal of implant and conversion of alloplastic genioplasty to an osteotomy.^{17,18} The rate of relapse is low and the ratio of soft tissue:hard tissue advancement on long-term follow-up is also stable over time, in the range of 0.85 to 1:1.^{7,26–29} However, surgical efforts to correct an excessively prominent chin is less predictable and should be proceeded with caution as the soft tissue response to posterior repositioning of the chin is, at best, 0.5:1.⁷ Guyuron and Raszewski retrospectively reviewed their genioplasty outcomes.³⁰ Overall, patients have a high satisfaction rate after genioplasty, with those who had osseous genioplasty having a slightly higher satisfaction rate (90–95%) than those who had alloplastic augmentation (85–90%). Morbidity was the same for either procedure with similar complication profile.

Conclusion

Genioplasty, either through implant augmentation or osteotomy, whether performed in isolation or as a component of formal orthognathic surgery, is an integral component of the aesthetic alteration of the face. When performed with proper

preoperative assessment and precise execution, the results can harmonize and restore balance between skeletal, soft tissue, and dental components of the lower face. Both implant and osseous genioplasty, with proper understanding of underlying dysmorphology, preoperative assessment, and surgical technique, can be relatively easy to perform and should be an integral component in the surgical armamentarium of a plastic surgeon.

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